Complete Summary

GUIDELINE TITLE

ACR Appropriateness Criteria™ for epilepsy.

BIBLIOGRAPHIC SOURCE(S)

Tanenbaum L, Drayer BP, Anderson RE, Braffman B, Davis PC, Deck MD, Hasso AN, Johnson BA, Masaryk T, Pomeranz SJ, Seidenwurm D, Masdeu JC. Epilepsy. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):459-70. [54 references]

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Epilepsy

GUIDELINE CATEGORY

Diagnosis

CLINICAL SPECIALTY

Neurological Surgery
Neurology
Radiology

INTENDED USERS

Health Plans
Hospitals
Managed Care Organizations

Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of initial radiologic examinations for epilepsy

TARGET POPULATION

Patients with epilepsy

INTERVENTIONS AND PRACTICES CONSIDERED

1. Magnetic resonance:
    - Plain
    - With/without contrast
    - Magnetic resonance angiography
    - Functional magnetic resonance
    - Perfusion
    - Spectroscopy
    - Activation
2. Single-photon emission computed tomography
3. Positron emission tomography
4. Magnetoencephalography/Magnetic source imaging
5. Computed tomography:
    - Plain
    - With/without contrast
6. Ultrasound
7. Catheter angiography

MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in differential diagnosis

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of recent peer-reviewed medical journals, primarily using the National Library of Medicine's MEDLINE database. The developer identified and collected the major applicable articles.

NUMBER OF SOURCE DOCUMENTS

The total number of source documents identified as the result of the literature search is not known.

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Expert Consensus (Delphi Method)
Weighting According to a Rating Scheme (Scheme Not Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed to reach agreement in the formulation of the Appropriateness Criteria. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as developed by the topic leader(s). Questionnaires are completed by the participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1-9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty (80) percent agreement is considered a consensus. If consensus cannot be reached by this method, the panel is convened and group consensus techniques are utilized. The strengths and weaknesses of each test or procedure are discussed and consensus reached whenever possible.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria and the Chair of the ACR Board of Chancellors.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria™

Clinical Condition: Epilepsy

Variant 1: Chronic epilepsy, poor therapeutic response.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Magnetic resonance		
Magnetic resonance plain	8	
Magnetic resonance with/without contrast	4	
Magnetic resonance angiography	2	
Functional magnetic resonance	No Consensus	
Functional		
Single-photon emission computed tomography	6	Single-photon emission computed tomography: ictal greater than interictal.
Positron emission tomography	6	Interictal positron emission tomography. Positron emission tomography of limited value if electroencephalogram focus is outside temporal lobe.
Magnetoencephalography/Magnetic source imaging	No Consensus	New application.

Computed tomography		
Computed tomography plain	4	
Computed tomography with/without contrast	4	
Ultrasound	2	
Catheter angiography	2	Except as necessary for WADA test.
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: New Onset Seizure

Variant 2: Ethyl alcohol, drug related.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Magnetic resonance		
Magnetic resonance plain	7	
Magnetic resonance with contrast	3	
Functional magnetic resonance perfusion	2	
Functional magnetic resonance spectroscopy	2	
Functional magnetic resonance activation	2	
Magnetic resonance angiography	2	
Computed tomography		
Computed tomography plain	7	
Computed tomography with contrast	3	
Functional		
Single-photon emission computed tomography	2	

Positron emission tomography	2	
Magnetoencephalography/Magnetic source imaging	2	
Ultrasound	2	
Interventional		
Angiography	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: New Onset Seizure

Variant 3: Aged 18 to 40 years.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Magnetic resonance		
Magnetic resonance plain	8	
Magnetic resonance with contrast	5	If indicated after review of noncontrast.
Functional magnetic resonance perfusion	2	
Functional magnetic resonance spectroscopy	2	
Functional magnetic resonance activation	2	
Magnetic resonance angiography	2	
Computed tomography		
Computed tomography plain	6	
Computed tomography with contrast	4	
Functional		
Single-photon emission computed tomography	4	

Positron emission tomography	4	
Magnetoencephalography/Magnetic source imaging	2	
Ultrasound	2	
Interventional		
Angiography	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: New Onset Seizure

Variant 4: Older than age 40.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Magnetic resonance		
Magnetic resonance plain	8	
Magnetic resonance with contrast	7	
Functional magnetic resonance perfusion	2	
Functional magnetic resonance spectroscopy	2	
Functional magnetic resonance activation	2	
Magnetic resonance angiography	2	
Computed tomography		
Computed tomography plain	6	
Computed tomography with contrast	4	If no magnetic resonance imaging is available. Magnetic resonance imaging preferred.
Functional		
Single-photon emission computed	4	

tomography		
Positron emission tomography	4	
Magnetoencephalography/Magnetic source imaging	2	
Ultrasound	2	
Interventional		
Angiography	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: New Onset Seizure

Variant 5: Focal neurological deficit.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Magnetic resonance		
Magnetic resonance plain	9	
Magnetic resonance with contrast	7	
Functional magnetic resonance perfusion	2	
Functional magnetic resonance spectroscopy	2	
Functional magnetic resonance activation	2	
Magnetic resonance angiography	2	
Computed tomography		
Computed tomography plain	6	If magnetic resonance imaging is not available or patient is uncooperative.
Computed tomography with contrast	6	If magnetic resonance imaging is not available or patient is uncooperative.
Functional		

Single-photon emission computed tomography	3	
Positron emission tomography	3	
Magnetoencephalography/Magnetic source imaging	2	
Ultrasound	2	
Interventional		
Angiography	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Summary

The classification of epileptic seizures by the International League Against Epilepsy was last revised in 1989 (see Appendix A in the original guideline document for an outline of the International Classification of Epileptic Seizures). The classification of seizure disorders is important because etiologic diagnosis, appropriate treatment, and accurate prognostication of seizure disorders all depend on the correct identification of seizures and epilepsy. There are two main seizure types: partial seizures and primary generalized seizures. Partial (formerly referred to as focal) seizures show either clinical or electroencephalography evidence of onset from a localized area within the cerebral hemisphere. The nature of the signs and symptoms in most cases of partial seizures indicate the region of the brain involved by the epileptic process. Partial seizures are designated as simple or complex. Complex partial seizures are associated with loss of consciousness. In simple seizures, the epileptic process is usually confined to neocortical structures, and the limbic system and brainstem are spared. Most simple seizures are less disabling than those associated with loss of consciousness. Partial seizures can spread and develop into secondarily generalized seizures. Primary generalized seizures originate simultaneously from both cerebral hemispheres, and clinical manifestations involve both sides of the body. Primary generalized seizures first occur at an earlier age, and are more likely to be associated with a family history of seizure disorders, but are less likely to be associated with focal cerebral lesions. A few seizure types remain unclassified because the underlying mechanism of their origin or propagation is unknown.

Certain types of seizure disorders are likely to be associated with structural brain lesions, including tumors, infection, infarction, traumatic brain injury, vascular malformations, developmental abnormalities, and seizure-associated brain pathology (see Appendix B in the guideline document), whereas others are not. Hence, knowledge of seizure types helps to determine whether neuroimaging is clinically indicated and what type of study is appropriate.

While the imaging evaluation of epilepsy was greatly advanced by the clinical introduction of computed tomography in the early 1970's, because of its superior soft tissue contrast, multiplanar imaging capability, and lack of beam hardening artifacts, virtually all the substrates of epilepsy are visualized with greater sensitivity and accuracy by magnetic resonance imaging. As a result, magnetic resonance has become the modality of choice for high-resolution structural imaging in epilepsy. Although routine evaluation techniques on the range of scanner field strengths may be sufficient for determination of mass lesions, optimized protocols for scans obtained on high-field (1.5 T) scanners may be necessary for evaluation of partial complex epilepsy, requiring scrutiny of the hippocampus and temporal lobe for atrophy and subtle signal alteration, as well as detection of certain structural abnormalities such as cortical dysplasias, hamartomas, and other developmental abnormalities. With the impending widespread clinical availability of high-performance magnetic resonance imaging systems, a comprehensive examination, with functional techniques providing additional information, adding corroborative information, and improving overall accuracy, may be of even greater value in epilepsy.

Although the data provided by magnetic resonance imaging is essential in the presurgical evaluation of patients with medically refractory epilepsy, structurally of detectable abnormalities are absent in many patients. In these patients, functional studies provide useful information on localization of the seizure focus. Functional imaging techniques, including positron emission tomography, single-photon emission computed tomography, magnetic source imaging, and functional magnetic resonance imaging, have contributed to the presurgical evaluation of patients with epilepsy.

Clinical positron emission tomography with fluorodeoxyglucose provides a measure of glucose uptake and thus metabolism, while single-photon emission computed tomography utilizing 99mTc-HMPAO (99mTc-hexamethyl propylene amine oxime) provides assessment of blood flow to the brain. A seizure focus will typically manifest as a focus of hypoperfusion and hypometabolism on interictal (between episodes of seizure activity) examinations and will be seen as a focus of increased activity on ictal (during seizure) examinations. Because of widespread clinical availability, ease of use, and the unique opportunity for ictal assessment, single-photon emission computed tomography has assumed increasing importance. Positron emission tomography suffers from lack of widespread availability and high cost, limiting its role in the localization of even temporal lobe seizure foci.

Functional magnetic resonance imaging techniques include phosphorus and proton spectroscopy, perfusion, and activation. The widespread application of most of these techniques in clinical practice depends on the impending widespread availability of high-performance magnetic resonance imagers capable of performing fast echo-planar pulse sequences, as well as off-line data post-processing capabilities.

Magnetic resonance spectroscopy is a set of noninvasive techniques for in vivo chemical analysis of the brain, some of which can be performed on standard-performance clinical magnetic resonance units. Although magnetic resonance spectroscopy has been used extensively for the past 30 years in molecular physics and chemistry, its application to the study of epilepsy is relatively recent. Widely

available proton and phosphorus single-voxel techniques have consistently demonstrated metabolite changes in the epileptogenic region of the brain. Magnetic resonance spectroscopic imaging or chemical shift imaging allows simultaneous acquisition of spectra from all brain regions. The pictorial display of magnetic resonance spectroscopy information facilitates comparison of the epileptogenic zone with the remainder of the brain, and provides localizing information. Chemical shift imaging is not yet widely available in clinical practice. Initial studies suggest that both proton and phosphorus magnetic resonance spectroscopy will be useful adjunctive presurgical tests for localization of seizure foci in patients with partial epilepsy, particularly in difficult cases, potentially reducing the need for intracranial-depth electrode electroencephalography recordings and those with extratemporal foci.

Cerebral blood volume assessment can be made during the first pass of an injected contrast agent such as a gadolinium chelate through the brain. Perfusion magnetic resonance techniques have demonstrated regional hyperperfusion, concordant with single-photon emission computed tomography, electroencephalography, and neurological findings in status epilepticus. Interictal hypoperfusion may also be detectable with this technique. While single-slice evaluation can be performed on any 1.5 T clinical imager, fast echo-planar pulse sequence techniques available on high performance machines allow assessment of whole-brain cerebral blood volume.

Only magnetoencephalography and electroencephalography are capable of measuring epileptic brain activity directly and with high temporal resolution (msec). The temporal resolution of positron emission tomography, single-photon emission computed tomography, and functional magnetic resonance imaging is poor by comparison (sec-min). Recent improvements in magnetoencephalography technology now allow whole brain coverage and overlay of source information on magnetic resonance or computed tomography images (with magnetic source imaging). Available data indicate that interictal magnetoencephalography can be an effective tool for localization of seizure foci. Significant shortcomings include limited availability, high cost, and assessment limited to relatively superficial and tangential sources. Nonetheless, magnetic source imaging does provide unique, accurate, and useful information about epileptogenic regions in the brain, and where available, is considered a standard part of the diagnostic workup of most patients with epilepsy.

CLINICAL ALGORITHM(S)

Algorithms were not developed from criteria guidelines.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Appropriate selection of radiologic exams to diagnose epilepsy in patients because etiologic diagnosis, appropriate treatment, and accurate prognostication of seizure disorders all depend on the correct identification of seizures and epilepsy.

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Tanenbaum L, Drayer BP, Anderson RE, Braffman B, Davis PC, Deck MD, Hasso AN, Johnson BA, Masaryk T, Pomeranz SJ, Seidenwurm D, Masdeu JC. Epilepsy. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):459-70. [54 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1996 (revised 1999)

GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

SOURCE(S) OF FUNDING

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria™.

GUIDELINE COMMITTEE

ACR Appropriateness Criteria™ Committee, Expert Panel on Neurologic Imaging

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Names of Panel Members: Thomas Masaryk, MD; Burton P. Drayer, MD; Robert E. Anderson, MD; Bruce Braffman, MD; Patricia C. Davis, MD; Michael D. F. Deck, MD; Anton N. Hasso, MD; Blake A. Johnson, MD; Stephen J. Pomeranz, MD; David Seidenwurm, MD; Lawrence Tanenbaum, MD; Joseph C. Masdeu, MD, PhD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline. It is a revision of a previously issued version (Appropriateness criteria for epilepsy. Reston [VA]: American College of Radiology [ACR]; 1996. 12 p. [ACR Appropriateness Criteria™]).

The ACR Appropriateness Criteria™ are reviewed after five years, if not sooner, depending upon introduction of new and highly significant scientific evidence. The next review date for this topic is 2004.

GUIDELINE AVAILABILITY

Electronic copies: Available from the American College of Radiology (ACR) Web site.

Print copies: Available from ACR, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on July 31, 2001. The information was verified by the guideline developer as of August 24, 2001.

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